E157 Lecture 12 Day Plan

Any questions before quiz

Quiz + Team Quiz + Talk through solution

Linear power calculations vs dB power calculations

- -10dBm incident on 100 Ohm load (Gamma=1/3)
- Return Loss = 20*log(1/3) → -9.5dB. Reflected wave is -19.5dBm
- Linear incident power: 100uW. Prefl=|Gamma|^2*Pin. Pload=(1-|Gamma|^2)*Pin
- 1/9*Pin is almost 1/10, which is why we get -9.5dB return loss

deciBel review

- Can add dB to dB → dB, cascaded gain
- dB to dBm → dBm, input to a system and output
- dB is ratio of power. dBm is an absolute measure. Square voltage ratios to get dB.
- 2x -> 3dB, 10x -> 10dB

Mismatch model and accounting for load powers, review

- GP
    - No match in numerator or denominator
    - Source loss, Rs terms, fall out of both equations in amplifier example
    - 1/(1-|S11|^2) in S param example compensates for input mismatch. "Makes gain appear bigger by amount reflected."
- GT
    - No match in numerator, match in denominator
    - No terms are cancelled in amplifier example
    - Just |S21|^2 in S param example. Implies matching doesn't matter, just property of S
    - Isn't that the opposite of amp example w/ both RS and RL mattering? b/c of ΓS=ΓL=0
- GA
    - Match in numerator, match in denominator
    - Source loss cancels again, but it's just 1/2 for both PavL and PavS (in amp example)
    - Weird S22 factor in S param example, can go to Rutgers Ofandi notes for full derivation

Word problems to identify power/transducer/available gain

- At S and L, ask "Is this available power? Or is this actual power?"
- If measuring voltages → GP
- If "how much comes out if this much gets in" → GP
- "If we were able to match the input, what would the gain be" → GT
- "What's the best we can do" → GA

Power at output of two port using power gain in dB

- 0dBm incident on network with S11=-20dB, S21=20dB
- Actual power to load? Given by GP. S11 v. small, so about 20dBm + 1%